REMARKS

Claims 1, 4-7, 10-14, 16-17, 20-21, 23-24, and 26 are pending, with claims 1, 7, 13, 17, 21, and 24 being independent. Claims 1, 7, 13, 17, 21, and 24 have been amended. No new matter has been added. Reconsideration and allowance of the above-referenced application are respectfully requested.

Rejection under 35 U.S.C. § 112 (¶ 2)

Claims 1, 4-7, 10-14, 16-17, 20-21, 23-24, and 26 stand rejected under 35 U.S.C. § 112 (second paragraph) as allegedly being indefinite. The Office states, "It is not clear why the scaling gain factor is needed. Scaling the target polynomial by a gain factor that is never used and ignored is indefinite."[1] The Office is respectfully reminded that claims must be interpreted as one having ordinary skill in the art would have interpreted the claims in light of and consistent with the supporting specification.[2] Accordingly, one skilled in the art would readily understand the scope of the claims when read in light of the specification, and, "If the claims read in light of the specification reasonably apprise those skilled in the art of the scope of the invention, 112 demands no more."[3] Nonetheless, the claims have been amended to clarify that the presently claimed subject matter does not itself cause scaling of the target polynomial by a gain factor.

Thus, the rejection under 35 U.S.C. § 112 (second paragraph) has been obviated by the present amendment, and withdrawal of the rejection is respectfully requested.

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[1] *See* 4-15-2010 Office Action at pages 2-3.
[2] *See Miles Lab., Inc. v. Shandon, Inc.*, 997 F.2d 870 (Fed. Cir. 1993).
[3] *See Credle v. Bond*, 25 F.3d 1556, 30 USPQ2d 1911 (Fed. Cir. 1994).

Rejections Under 35 U.S.C. §§ 102 & 103

Claims 13-14 stand rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Cideciyan et al. (U.S. Patent No. 6,377,635, hereinafter Cideciyan). Claims 1, 4-7, 10-12, 17, 20-21, 23-24, and 26 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Cideciyan in view of Fisher et al. (U.S. Patent No. 6,249,398, hereinafter Fisher). Claim 16 stands rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Cideciyan in view McEwen et al. (U.S. Patent No. 6,366,418, hereinafter McEwen). These contentions are respectfully addressed.

In rejecting the claims, the Office disregards the final wherein clause of each independent claim, stating, "The Examiner does not give functional weight to the claimed gain factor since the gain factor is not utilized in the system or not considered[.]"[4] The Office has further stated that, "the Examiner has considered that the claimed limitation has no functional use. The system or method does not utilize the gain factor and ignores it."[5] This is clearly improper in view of the specification in the present application. In fact, it appears that the Office failed to even take into account the teachings of the present application when construing the new claim language. As described in the Specification:[6]

> When there is uncertainty about the gain of the partial response channel, then a gain factor can be introduced in the target partial response, and the target partial response can be written as $P' = [\alpha p_0 \quad \alpha p_1 \quad \cdots \quad \alpha p_M]$. This equation assumes

[4] *See* 4-15-2010 Office Action at pages 4, 7, and 9.
[5] *See* 4-15-2010 Office Action at page 11.
[6] *See* Specification at ¶ 24-26 (emphasis added).

that the function only changes in the amplitude; the relative scaling of the different terms remains the same. The traditional Viterbi decision sequence should then be the estimated input sequence $\hat{B}' = \left[\hat{b}'_0 \quad \hat{b}'_1 \quad \cdots \quad \hat{b}'_N\right]$, which minimizes the quantity,

$$(1) \qquad \sum_{k=0}^{N} \left(y_k - \hat{y}'_k\right)^2 ,$$

where $\hat{y}'_k = \sum_{l=0}^{M} \hat{b}'_{k-l} \cdot \alpha \cdot p_l = \alpha \cdot \sum_{l=0}^{M} \hat{b}'_{k-l} \cdot p_l = \alpha \cdot y^*_k$, and $y^*_k = \sum_{l=0}^{M} \hat{b}'_{k-l} \cdot p_l$. The quantity in equation (1) can be re-written as,

$$(2) \qquad \sum_{k=0}^{N} \left(y_k - \hat{y}'_k\right)^2 = \sum_{k=0}^{N} \left(y_k - \alpha \cdot y^*_k\right)^2 = \sum_{k=0}^{N} y_k^2 + \alpha^2 \cdot \sum_{k=0}^{N} \left(y^*_k\right)^2 - 2\alpha \sum_{k=0}^{N} y_k \cdot y^*_k .$$

The three terms on the right side of equation (2) can be understood as the summation of the square of the real output of the channel, the summation of the square of the estimated channel output scaled by the channel gain factor, and the cross-correlation of the real channel output and the estimated channel output scaled by the channel gain factor. Since $\sum_{k=0}^{N} y_k^2$ is not a function of the choice of $\hat{B}$ (the estimated input sequence), minimizing the quantity in equation (2) over B' is equivalent to minimizing

$$(3) \qquad \alpha^2 \cdot \sum_{k=0}^{N} \left(y^*_k\right)^2 - 2\alpha \sum_{k=0}^{N} y_k \cdot y^*_k$$

or, since α is not a function of the estimated input,

$$(4) \qquad \alpha \cdot \sum_{k=0}^{N} \left(y^*_k\right)^2 - 2 \sum_{k=0}^{N} y_k \cdot y^*_k .$$

When α is small, the first term in equation (4) can be ignored, and the Viterbi algorithm can be used to minimize the second term (i.e., maximize the correlation, as the second term is negative in equation (4)). When the noise power is not

changing with the amplitude of the signal and the signal amplitude is very small, maximizing the second term is essentially the same as minimizing the whole quantity, providing close to optimal performance.

When the signal amplitude is very large, the first term in equation (4) is still ignored, resulting in less than optimal performance as compared with traditional Viterbi in terms of error probability. But because the signal to noise ratio (SNR) is higher with larger amplitudes of the signal, good results can still be obtained. By maximizing the correlation between the sampled sequence and the recovered sequence, received sequences can be accurately interpreted, even when the signal carrying the sequences has a widely varying amplitude. A signal processing apparatus using these techniques can be biased to the worst case, guaranteeing the performance of the worst case scenario.

Thus, when read in light of the specification, the final wherein clause of each independent claim clearly defines an aspect of the claimed subject matter that serves to limit the scope of the claims, distinguish the cited art, and has utility. For example, by only maximizing the cross correlation, a decoder can be built that requires a less complicated design (e.g., potentially less circuitry, components, costs, etc.) and still obtains good results even though the error probability performance can be less than optimal. The Office is respectfully reminded that claim interpretations that render some portion of the claim language superfluous are disfavored,[7] and on this basis alone, all of the rejections under 35 U.S.C. §§ 102 & 103 should be withdrawn for failing to properly construe and consider all elements of the claim language, as a whole.

With respect to independent claim 1, the plain meaning of determining an input sequence of the partial response channel by maximizing cross-correlation of an estimated output sequence

[7] *See Pickholtz v. Rainbow Techs., Inc.*, 284 F.3d 1365, 1373 (Fed. Cir. 2002), *citing Elekta Instrument S.A. v. O.U.R. Scientific International, Inc.*, 214 F.3d 1302, 1307 (Fed. Cir. 2000.).

with the obtained output sequence, as recited in the claim, is that the constant terms are ignored. Cideciyan never suggests such subject matter, as claimed, and the Office has failed to provide any citation in support of a conclusion that Cideciyan suggests only maximizing the cross correlation. Furthermore, the Office's bare citation to Figs. 8-14 of Cideciyan[8] fails to support the contention that Cideciyan teaches that "all the survivor paths merge in M steps", as recited in the claim. Thus, there is a clear legal or factual deficiency in the current rejection for at least this reason.

Independent claims 7 and 17 recite similar language as found in claim 1, and Fisher fails to cure the deficiencies of Cideciyan. Thus, for at least the above reasons, each of independent claims 1, 7 and 17 should be in condition for allowance. Dependent claims 4-6, 10-12, and 20 should be allowable based on at least the above arguments.

With respect to independent claim 13, Cideciyan does not teach a branch metric generator that generates branch metrics consisting of the cross-correlation term, which is referred to in Cideciyan as the data-dependent or time varying term. In fact, Cideciyan explicitly states the opposite:[9]

> In accordance with features of the invention, the branch metrics are transformed so that some of the constant terms and all of the data dependent or time-varying terms are shifted after the add/compare/select (ACS) unit and added directly to the state metrics. [...] the branch metrics themselves become constants.

Thus, independent claim 13 does not read on Cideciyan.

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[8] *See* 4-15-2010 Office Action at page 6.
[9] *See* Cideciyan at col. 3, lines 34-43.

Cideciyan does not teach using the claimed cross-correlation in the branch metrics generated by a branch metric generator, which branch metrics are then used by an add-compare-select component to determine survivor paths, as presently claimed. This fact is not refuted by the Office's noting that:[10]

> Figures 3-13, shows the trellis performing ACS (Add-Compare-Select) operations to find the updated state metrics by using branch metric data dependent terms. Therefore, Cideciyan teaches of the branch metrics used by an add-compare-select component to determine survivor paths.

It is clear from Cideciyan's description that the branch metrics used by an add-compare-select component are not the same as branch metrics used by a branch metric generator. In fact, Cideciyan explicitly states in multiple places that his transformed metric shifts the channel output dependent term of the branch metric "after the ACS units leaving on the trellis branches only constants."[11]

For at least the above reasons, independent claim 13 should be in condition for allowance. Since McEwen fails to cure the deficiencies of Cideciyan, each of dependent claims 14 and 16 should be allowable based on at least the above arguments.

Independent claim 21 recites, "an input line that provides a sampled channel sequence; and Viterbi detection means for determining a recovered sequence from the sampled channel sequence, the Viterbi detection means including means for maximizing cross-correlation of the recovered sequence and the sampled channel sequence; wherein the sampled channel sequence comprises a waveform of widely varying amplitude, and the Viterbi detection means provides

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[10] *See* 09-08-2009 Office Action at page 10.
[11] *See* Cideciyan at col. 4, lines 28-31, and lines 58-62 (emphasis added).

robust tolerance of phase uncertainty with the waveform of widely varying amplitude including providing accurate detection decisions even when the amplitude of the waveform is very small[.]"[12] The arguments presented above regarding maximizing cross-correlation are applicable to claim 21 as well. In addition, note that claim 21 uses "means for" language and that:[13]

> Where means plus function language is used to define the characteristics of a machine or manufacture invention, such language must be interpreted to read on only the structures or materials disclosed in the specification and "equivalents thereof" that correspond to the recited function. Two *en banc* decisions of the Federal Circuit have made clear that the USPTO is to interpret means plus function language according to 35 U.S.C. § 112, sixth paragraph.

In the present case, the Office has failed to comply with this legal requirement, making no effort to identify how the claim language has been interpreted to read on only the structures disclosed in the specification or equivalents thereof. The statement in the Advisory Action dated 11-23-2009 that the specification or the figures do not show any structure for the Viterbi detection is clearly incorrect. Figure 2 and 7 to 15-2 clearly represent structures and have corresponding description thereof. Thus, there is a clear legal or factual deficiency in the rejection of claim 21 for at least this reason.

Moreover, Fisher uses an error generator 64 to provide input via a path 67 to timing control circuitry 70, which in turn adjusts the sampling phase of the sampler 46. However,

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[12] Emphasis added.
[13] *See* MPEP § 2106(II)(C) (emphasis added).

components 64, 67, 70 and 46 are clearly separate from the Viterbi detector 60.[14] Thus, these components cannot be equated with the claimed subject matter, where "the Viterbi detection means provides robust tolerance of phase uncertainty."[15] In response to this point, the Office stated:[16]

> Examiner submits that Fisher discloses of a timing recovery unit to provide a robust tolerance of phase uncertainty to the signal inputted in the Viterbi detector from the loop as shown in Figure 2. Eventhough, the error generator is outside the Viterbi Detector, the error generator is coupled to the Viterbi Detector and the robust tolerance of phase uncertainty performed by the Timing Control is based on both the input and output of the Viterbi detector (output of the error generator).

Thus the Office admits that Fisher describes processing done to the signal provided to the Viterbi detector 60, where this signal processing is done by components outside the Viterbi detector 60, not signal processing performed by the Viterbi detector 60. These are significant structural differences. Since the claim uses "means for" language, the Office is not free to disregard structural differences between the claimed subject matter and the cited art.[17] Thus, there is a clear legal or factual deficiency in the rejection of claim 21 for at least this additional reason.

For at least the above reasons, claim 21 should be allowable. Independent claim 24 recites similar language as found in claim 21. Thus, for at least the above reasons, independent

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[14] *See* Fisher at FIG. 2.
[15] Emphasis added.
[16] *See* 09-08-2009 Office Action at page 11.
[17] *See* MPEP § 2106(II)(C).

claim 24 should also be in condition for allowance. Dependent claims 23 and 26 should be allowable based on at least the above arguments.

Conclusion

The foregoing comments made with respect to the positions taken by the Office are not to be construed as acquiescence with other positions of the Office that have not been explicitly contested. Accordingly, the arguments for patentability of a claim should not be construed as implying that there are not other valid reasons for patentability of that claim or other claims.

In view of the present response, all of the claims should be in condition for allowance. Should there be any questions regarding the present amendments and remarks, the undersigned attorney would be happy to engage in a telephone interview to resolve any remaining issues.

A formal notice of allowance is respectfully requested. Please apply any necessary charges, or credits, to deposit account 06-1050.

Respectfully submitted,

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